

Assessment of Racial/Ethnic Disparities in Timeliness and Comprehensiveness of Dementia Diagnosis in California

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IMPORTANCE The US aging population is rapidly becoming more racially and ethnically diverse. Early diagnosis of dementia is a health care priority.

OBJECTIVE To examine the associations between race/ethnicity and timeliness of dementia diagnosis and comprehensiveness of diagnostic evaluation.

DESIGN, SETTING, AND PARTICIPANTS This retrospective cross-sectional study used 2013-2015 California Medicare fee-for-service data to examine the associations of race/ethnicity, individual factors, and contextual factors with the timeliness and comprehensiveness of dementia diagnosis. Data from 10 472 unique beneficiaries were analyzed. The sample was selected on the basis of the following criteria: presence of 1 or more claims; no diagnoses of dementia or mild cognitive impairment in 2013 to 2014; continuous enrollment in Medicare Parts A and B; Asian, Black, Hispanic, or White race/ethnicity; and incident diagnoses of dementia or mild cognitive impairment in January through June 2015. Data analyses were conducted from November 1, 2019, through November 10, 2020.

MAIN OUTCOMES AND MEASURES Timeliness of diagnosis, defined as incident diagnosis of mild cognitive impairment vs dementia, and comprehensiveness of diagnostic evaluation, defined as presence of the following services in claims within 6 months before or after the incident diagnosis date: specialist evaluation, laboratory testing, and neuroimaging studies.

RESULTS The sample comprised 10 472 unique Medicare beneficiaries with incident diagnoses of dementia or mild cognitive impairment (6504 women [62.1%]; mean [SD] age, 82.9 [8.0] years) and included 993 individuals who identified as Asian (9.5%), 407 as Black (3.9%), 1255 as Hispanic (12.0%), and 7817 as White (74.6%). Compared with White beneficiaries, those who identified as Asian (odds ratio, 0.46; 95% CI, 0.38-0.56), Black (odds ratio, 0.73; 95% CI, 0.56-0.94), or Hispanic (odds ratio, 0.62; 95% CI, 0.52-0.72) were less likely to receive a timely diagnosis. Asian beneficiaries (incidence rate ratio, 0.81; 95% CI, 0.74-0.87) also received fewer diagnostic evaluation elements. These associations remained significant after adjusting for age, sex, comorbidity burden, neighborhood disadvantage, and rurality.

CONCLUSIONS AND RELEVANCE These findings highlight substantial disparities in the timeliness and comprehensiveness of dementia diagnosis. Public health interventions are needed to achieve equitable care for people living with dementia across all racial/ethnic groups.

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Dementia is a syndrome characterized by declines in cognitive, behavioral, social, and functional domains and is one of the leading causes of disability and loss of independence in older adults worldwide.¹ With increasing longevity, the prevalence and burden of dementia are increasing exponentially,^{1,2} particularly with regard to public health costs.³ Early diagnosis of dementia is a health care priority,⁴⁻⁷ and its benefits include opportunities to identify causes, to inform and coordinate medical care, to enable planning for the future, to address potential safety issues, to connect families with interventions, and to identify appropriate candidates for clinical trials of potentially disease-modifying therapies that are anticipated to benefit patients in early disease stages.⁸⁻¹² Mild cognitive impairment (MCI) is largely recognized as a prodromal phase of neurodegenerative disease,¹³ and diagnostic practice recommendations focus on diagnosis of MCI as an early stage of dementia based on results of comprehensive workup.¹⁴⁻¹⁶ Although specific elements of diagnostic evaluations may vary by setting and the needs of each patient, a comprehensive workup typically includes evaluation by a clinician with dementia specialty expertise and laboratory and neuroimaging studies to help identify underlying causes, including potential nonneurodegenerative causes.¹⁴⁻¹⁶

Age is the main risk factor for dementia, and, in the US, the aging population is rapidly becoming more racially/ethnically diverse.¹⁷ At the same time, racial/ethnic minority status has been associated with numerous social and economic inequalities, including poverty, lower quality of education, poorer general health, discrimination, and reduced health care access and quality.¹⁸⁻²⁰ Moreover, recent findings suggest that racial/ethnic gaps in older adults' self-reported health have widened during the past 2 decades.²¹ Within dementia research, a growing body of evidence highlights racial/ethnic disparities in dementia incidence²² and prevalence,²³ as well as social and medical risk factors for dementia.²⁴ In addition, undiagnosed dementia may be more common among racially/ethnically diverse individuals, particularly African American individuals²⁵ and Hispanic and Latino individuals²⁶ compared with White individuals. In addition, beyond race/ethnicity, there is growing recognition that social determinants of health, comorbid medical conditions, and variability in health behavior patterns are likely associated with these inequalities.^{3,18,19} A deeper understanding of the multidimensional mechanisms underlying health care disparities in late life is a public research priority as outlined in the National Institute on Aging Health Disparities Framework.²⁷ Among these mechanisms, rurality has been associated with reduced access to medical care,²⁸ including limited access to specialists and lack of community support for diagnosis and treatment of dementia among rural clinicians.²⁹ Similarly, greater neighborhood disadvantage has been associated with limited access to care,³⁰ poorer management of chronic disease,³¹ reduced cerebral gray matter volumes,³² and increased risk of Alzheimer disease neuropathologic findings among older adults in the US.³³ Taken together, these findings highlight significant associations of race/ethnicity, as well as social determinants of health factors, with health care disparities among older adults. However, to our knowledge, little is known about

Key Points

Question Is race/ethnicity associated with timeliness of dementia diagnosis and comprehensiveness of dementia diagnostic workup?

Findings In this cross-sectional study of 10 472 California Medicare fee-for-service beneficiaries, Asian, Black, and Hispanic beneficiaries were less likely than White beneficiaries to receive a diagnosis of incident mild cognitive impairment vs dementia. Asian beneficiaries were also less likely to receive key elements of a diagnostic evaluation compared with White beneficiaries.

Meaning A lower likelihood of early diagnosis of dementia and comprehensive diagnostic workup among beneficiaries from racial/ethnic minority groups highlights key areas for public health interventions to reduce health disparities among older adults.

potential racial/ethnic differences with regard to timeliness and comprehensiveness of dementia diagnosis. Addressing this gap is of critical value for informing public health and policy interventions.

According to 2019 US Census estimates, California has the largest population of older adults of any state, with approximately 11% of the total national population aged 65 years or older, and it is one of the most diverse states with regard to racial/ethnic constitution of the older adult population.³⁴ In this study, we leveraged a 100% sample of Medicare fee-for-service beneficiaries in California with incident diagnoses of dementia or MCI to examine the associations of race/ethnicity with the timeliness and comprehensiveness of dementia diagnosis. We also examined independent associations of individual factors (age, sex, and comorbidity burden) and contextual factors (rurality and neighborhood disadvantage) with outcome variables. Finally, we explored interactions between race/ethnicity and individual and contextual variables to elucidate any potential overlapping associations of these variables with the timeliness and comprehensiveness of dementia diagnosis. Based on prior work, we hypothesized that beneficiaries who identified as Asian, Black, and Hispanic would have a lower likelihood of having an incident diagnosis of MCI vs dementia and receiving a comprehensive diagnostic workup, and that the associations between race/ethnicity and diagnostic outcome variables would remain significant after controlling for individual and contextual factors.

Methods

Data Source

We used the Centers for Medicare & Medicaid (CMS) administrative enrollment and claims data for 100% of Medicare beneficiaries enrolled in the fee-for-service program in California from 2013 through 2015 (N = 6 293 386). Data for individuals enrolled in Medicare Advantage were not available. We used data from all available claim types, including carrier, durable medical equipment, home health agency, hospice, inpatient, outpatient, and skilled nursing facility. Data were obtained and

used with permission from and a data use agreement with the Research Data Assistance Center.³⁵ Data use fully complied with the requirements of the Privacy Act, the Health Insurance Portability and Accountability Act Privacy Rule, and CMS data release policies. The study was approved by the University of California, San Francisco Committee on Human Research, and informed consent was waived because the use or disclosure of the requested information did not adversely affect the rights and welfare of the beneficiaries and involved no more than a minimal risk to their privacy.

Study Population

We included California Medicare fee-for-service beneficiaries with incident diagnoses of either dementia or MCI who were continuously enrolled in Medicare Parts A and B from January 1, 2013, through December 31, 2015 (eTable 1 in the Supplement). Incident diagnosis was established based on methods modeled after CMS Chronic Condition algorithms³⁶ with data from January 1, 2013, through December 31, 2014, used as a 2-year lookback period to ensure absence of either cognitive diagnosis in past claims. The dates of incident diagnoses were limited to January 1 through June 30, 2015, and a 6-month prediagnosis and postdiagnosis window was used to identify diagnostic workup services. For individuals with more than 1 diagnosis in claims files between January 1 and June 30, 2015, the earliest recorded diagnosis within this period was used.

The primary independent variable was race/ethnicity reported in the Master Beneficiary Summary Files, including "Asian," "Black," "Hispanic," and "White." In our primary analyses, we used the Research Triangle Institute race/ethnicity codes that are derived from an imputation algorithm based on surnames, given prior evidence of better representation of Asian and Hispanic beneficiaries using this coding system.³⁷ In sensitivity analyses, we used the Medicare Enrollment Database race/ethnicity codes that are based on self-report.³⁷ We excluded beneficiaries whose self-reported race/ethnicity was North American Native owing to low sample size (eTable 1 in the Supplement) and the possibility of poor representation of this population in Medicare claims data in light of the availability of alternative health care coverage programs.³⁸

Outcomes

We defined "timeliness of diagnosis" as a dichotomous variable of incident diagnosis of MCI (dummy coded as 1) vs all-cause dementia (dummy coded as 0). The diagnoses of MCI and dementia were determined based on *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis codes widely used in prior studies³⁹⁻⁴² (eTable 2 in the Supplement). We developed the algorithm for quantifying the comprehensiveness of diagnostic workup based on published practice recommendations¹⁴⁻¹⁶ and defined it as a count outcome (dummy coded as 0-3) based on the presence of the following recommended services: specialist evaluation, brain health laboratory testing, and neuroimaging studies. Specialist evaluation was determined based on the published clinician type taxonomy codes,⁴³ as reported in existing literature,⁴⁴ and included the following clinician types: geriatrician, geri-

atric psychiatrist, neurologist, and neuropsychologist (eTable 3 in the Supplement). Laboratory testing was based on the presence of a minimally recommended blood test workup, specifically vitamin B₁₂ and thyrotropin studies¹⁴⁻¹⁶ (eTable 4 in the Supplement). Neuroimaging variables were based on the presence of either head computerized tomography or brain magnetic resonance imaging studies (eTable 4 in the Supplement). Each of the constituent metrics was dummy coded as either 1 (≥ 1 frequency of the service in base claims or revenue center data) or 0 (service not present in base claims or revenue center data) within 6 months before and after the incident diagnosis date.

Covariates

Individual characteristics, including age (in years), sex (dummy coded as 0 = male and 1 = female), and comorbidity burden were included as covariates. Comorbidity burden was estimated within 6 months before and after the incident diagnosis date and was based on the Elixhauser Comorbidity Index.⁴⁵ Additional contextual covariates were rurality and neighborhood disadvantage. Rurality was established using 2010 Rural-Urban Commuting Area codes⁴⁶ based on zip+4 codes reported in Master Beneficiary Summary Files and was coded into 5 categories: metropolitan, micropolitan high commute, micropolitan low commute, small town or rural high commute, and small town or rural low commute⁴⁶ (eTable 5 in the Supplement). Neighborhood disadvantage was measured by the area deprivation index (ADI), a publicly available composite metric of neighborhood characteristics incorporating 17 measures of education, employment, housing quality, and poverty.⁴⁷ We used the state-level ADI decile scores coded as high ADI (deciles 9-10; most disadvantage), middle ADI (deciles 3-8; intermediate disadvantage), and low ADI (deciles 1-2; least disadvantage).⁴⁸

Statistical Analysis

Statistical analyses were conducted from November 1, 2019, to November 10, 2020. Logistic regression models were performed to investigate the association between race/ethnicity and timeliness of diagnosis (dichotomous outcome: MCI vs dementia). Models were performed without (unadjusted) and with (fully adjusted) covariates, which included age, sex, comorbidity burden, rurality, and neighborhood disadvantage. To facilitate the interpretation of findings, we calculated odds ratios (ORs) based on unadjusted and fully adjusted models. Similarly, we fit unadjusted and fully adjusted Poisson regression models to examine the association between race/ethnicity and number of recommended diagnostic services (count outcome: 0-3). We calculated incidence rate ratios (IRRs) based on the unadjusted and fully adjusted models to facilitate interpretation of findings. In addition, marginal effects of race/ethnicity were estimated for fully adjusted models to further facilitate a quantitative interpretation of the results while keeping other covariates fixed.

In supplementary analyses, we tested interaction terms between race/ethnicity and each of the other demographic and geographical factors for the outcomes with fully adjusted models. To examine whether an evaluation with a dementia

Table 1. Demographic Characteristics of California Medicare FFS Beneficiaries With Incident Diagnoses of Dementia or MCI

Characteristic	White, No. (%) (n = 7817) ^a	Asian, No. (%) (n = 993) ^a	P value ^b	Black, No. (%) (n = 407) ^a	P value ^b	Hispanic, No. (%) (n = 1255) ^a	P value ^b
% of Total sample	74.6	9.5	NA	3.9	NA	12.0	NA
% of All beneficiaries without prior diagnoses ^c	0.6	0.5	.32	0.5	.33	0.5	.39
Age, mean (SD), y	83.4 (8.1)	82.9 (7.7)	.10	80.4 (8.4)	<.001	80.9 (7.7)	<.001
Female sex	4838 (61.9)	643 (64.8)	.09	245 (60.2)	.53	778 (62.0)	.97
High neighborhood disadvantage (ADI)	1189 (15.2)	126 (12.7)	.02	101 (24.8)	<.001	434 (34.6)	<.001
Metropolitan residence	6730 (86.1)	972 (97.9)	<.001	394 (96.8)	<.001	1122 (89.4)	.002
Elixhauser score, mean (SD)	4.8 (2.9)	4.8 (2.9)	.55	5.2 (3.0)	.005	5.1 (3.0)	<.001
Incident MCI diagnosis	1825 (23.3)	122 (12.3)	<.001	74 (18.2)	.02	198 (15.8)	<.001
Recommended services							
Specialist evaluation	2769 (35.4)	286 (28.8)	<.001	151 (37.1)	.52	415 (33.1)	.11
Laboratory testing	1345 (17.2)	101 (10.2)	<.001	58 (14.3)	.14	194 (15.5)	.14
Neuroimaging studies	2270 (29.0)	260 (26.2)	.07	106 (26.0)	.21	373 (29.7)	.65

Abbreviations: ADI, area deprivation index; FFS, fee-for-service; MCI, mild cognitive impairment; NA, not applicable.

^a Race/ethnicity based on Research Triangle Institute algorithm.

^b Based on independent-sample t tests for continuous variables or χ^2 tests for

categorical variables derived from comparisons with the White group.

^c Percentage of total Medicare beneficiaries in 2015 in the same racial/ethnic group.

specialist modified the results, we repeated our fully adjusted logistic and Poisson models only for beneficiaries with a specialist encounter. In sensitivity analyses, we repeated all primary logistic and Poisson models using the Medicare Enrollment Database race/ethnicity codes.

All analyses were performed in R, version 4.0.2 (R Foundation for Statistical Computing).⁴⁹ All analyses were 2-sided, and significance was set at $P < .05$ using the false discovery rate (FDR) approach to account for multiple comparisons. All models were checked for overdispersion, influential values, and multicollinearity, and Hosmer-Lemeshow tests were performed to ensure goodness of fit of multivariable models.

Results

Sample Characteristics

Of the 1 892 633 California Medicare beneficiaries with no prior diagnoses of dementia or MCI from 2013 through 2014 (eTable 1 in the Supplement), 10 472 (0.6%) received an incident diagnosis in January through June 2015, with no significant group differences across racial/ethnic groups (Table 1). In the incident diagnosis study cohort, (62.1% women and 37.9% men; mean [SD] age, 82.9 [8.0] years), 9.5% of the individuals identified as Asian, 3.9% as Black, 12.0% as Hispanic, and 74.6% as White. A minority of beneficiaries received a timely diagnosis with elements of a comprehensive evaluation: 21.2% of beneficiaries received a diagnosis of incident MCI (vs dementia), 34.6% received a specialist evaluation, 16.2% had recommended laboratory testing, and 28.7% had neuroimaging studies. Compared with White beneficiaries, those who identified as Asian were more likely to reside in metropolitan areas (97.9% vs 86.1%) and were less likely to receive an incident MCI diagnosis (12.3% vs 23.3%), a specialist evaluation (28.8% vs 35.4%), or laboratory tests (10.2% vs 17.2%) (Table 1). Compared with White beneficiaries, Black beneficiaries were

younger (mean [SD] age, 80.4 [8.4] vs 83.4 [8.1] years), more likely to reside in highly disadvantaged neighborhoods (24.8% vs 15.2%) and metropolitan areas (96.8% vs 86.1%), had a greater comorbidity burden (mean [SD] Elixhauser score, 5.2 [3.0] vs 4.8 [2.9]), and were less likely to receive an incident MCI diagnosis (18.2% vs 23.3%). Compared with White beneficiaries, Hispanic beneficiaries were also younger (mean [SD] age, 80.9 [7.7] vs 83.4 [8.1] years), more likely to reside in highly disadvantaged neighborhoods (34.6% vs 15.2%) and metropolitan areas (89.4% vs 86.1%), had a greater comorbidity burden (mean [SD] Elixhauser score, 5.1 [3.0] vs 4.8 [2.9]), and were less likely to receive an incident MCI diagnosis (15.8% vs 23.3%).

Racial/Ethnic Differences in Timeliness of Diagnosis

Results of unadjusted and fully adjusted logistic regression models are presented in Table 2. Area deprivation index values could not be linked for 3.9% of beneficiaries and were excluded from fully adjusted models. Compared with White beneficiaries, those who identified as Asian (OR, 0.46; 95% CI, 0.38-0.56; $P < .001$, using the FDR approach), Black (OR, 0.73; 95% CI, 0.56-0.94; $P = .02$, using the FDR approach), and Hispanic (OR, 0.62; 95% CI, 0.52-0.72; $P < .001$, using the FDR approach) were less likely to receive an incident diagnosis of MCI vs dementia. After adjustment for demographic and geographical factors, these differences remained significant, with Asian beneficiaries having the lowest likelihood of an incident MCI diagnosis (OR, 0.45; 95% CI, 0.37-0.55; $P < .001$, using the FDR approach), followed by Hispanic (OR, 0.65; 95% CI, 0.55-0.77; $P \leq .001$, using the FDR approach) and Black (OR, 0.70; 95% CI, 0.53-0.91; $P = .01$, using the FDR approach) beneficiaries (Figure). The estimated mean marginal effects of race/ethnicity on incident diagnosis of MCI were -11.0% (95% CI, -13.2% to -8.8% ; $P < .001$, using the FDR approach) for Asian beneficiaries, -6.6% (95% CI, -8.9% to -4.2% ; $P < .001$, using the FDR approach) for Hispanic beneficiaries, and -5.6% (95% CI, -9.4% to -1.7% ; $P = .01$, using the FDR approach) for

Table 2. Associations of Race/Ethnicity, Individual Factors, and Contextual Factors With Incident Diagnosis of Mild Cognitive Impairment vs Dementia

Characteristic	Unadjusted model ^a			Fully adjusted model ^b		
	B (SE) value	z Score	P value ^c	B (SE) value	z Score	P value ^c
Race/ethnicity						
Asian	-0.777 (0.100)	-7.75	<.001	-0.802 (0.103)	-7.82	<.001
Black	-0.315 (0.131)	-2.40	.02	-0.356 (0.138)	-2.58	.01
Hispanic	-0.486 (0.082)	-5.93	<.001	-0.429 (0.087)	-4.94	<.001
Age (+5 y)	NA	NA	NA	-0.045 (0.003)	-14.27	<.001
Female sex	NA	NA	NA	-0.065 (0.051)	-1.26	.21
Neighborhood disadvantage						
High ADI	NA	NA	NA	-0.319 (0.075)	-4.24	<.001
Low ADI	NA	NA	NA	0.454 (0.057)	7.91	<.001
Rurality						
Micropolitan						
HC	NA	NA	NA	-0.070 (0.134)	-0.52	.60
LC	NA	NA	NA	-0.223 (0.146)	-1.52	.13
Small town or rural						
HC	NA	NA	NA	0.130 (0.194)	0.67	.50
LC	NA	NA	NA	-0.328 (0.181)	-1.82	.07
Elixhauser score (+1)	NA	NA	NA	-0.043 (0.009)	-4.82	<.001

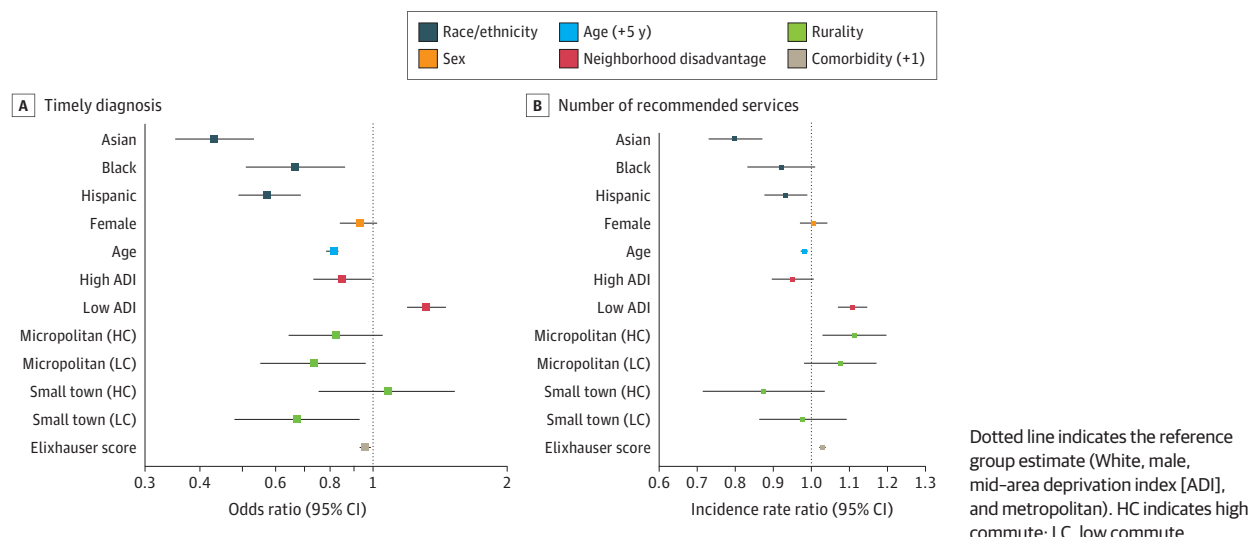
Abbreviations: ADI, area deprivation index; B, logistic regression coefficient; HC, high commute; LC, low commute; NA, not applicable.

^b Reference group: White, male, mid-ADI, and metropolitan.

^c Using the false discovery rate approach.

^a Reference group: White.

Figure. Adjusted Odds Ratios and Incidence Rate Ratios of Timely Diagnosis and Number of Recommended Diagnostic Services by Race/Ethnicity, Individual Factors, and Contextual Factors



Black beneficiaries. Other variables associated with lower likelihood of an incident MCI diagnosis were increasing age (OR for every additional 5 years, 0.80; 95% CI, 0.77-0.82; $P < .001$, using the FDR approach), residence in a highly disadvantaged neighborhood (OR, 0.73; 95% CI, 0.63-0.84; $P < .001$, using the FDR approach), and greater comorbidity burden (OR for every additional comorbid condition, 0.96; 95% CI, 0.94-0.98; $P < .001$, using the FDR approach) (Figure).

Racial/Ethnic Differences in Comprehensiveness of Diagnostic Workup

Table 3 summarizes the results of unadjusted and fully adjusted Poisson models. Compared with White beneficiaries, individuals who identified as Asian were less likely to receive recommended diagnostic workup services (IRR, 0.81; 95% CI, 0.74-0.87; $P < .001$, using the FDR approach). In fully adjusted models for individual and contextual covariates, the

Table 3. Associations of Race/Ethnicity, Individual Factors, and Contextual Factors With the Number of Recommended Diagnostic Services Performed

Characteristic	Unadjusted model ^a			Fully adjusted model ^b		
	B (SE) value	z Score	P value	B (SE) value	z Score	P value ^c
Race/ethnicity						
Asian	-0.216 (0.042)	-5.19	<.001	-0.214 (0.042)	-5.11	<.001
Black	-0.061 (0.059)	-1.03	.31	-0.070 (0.060)	-1.17	.24
Hispanic	-0.044 (0.035)	-1.25	.21	-0.035 (0.036)	-0.98	.33
Age (+5 y)	NA	NA	NA	-0.016 (0.001)	-11.57	<.001
Female sex	NA	NA	NA	0.019 (0.023)	0.83	.40
Neighborhood disadvantage						
High ADI	NA	NA	NA	-0.095 (0.032)	-2.98	.003
Low ADI	NA	NA	NA	0.192 (0.026)	7.27	<.001
Rurality						
Micropolitan						
HC	NA	NA	NA	0.181 (0.054)	3.31	<.001
LC	NA	NA	NA	0.144 (0.060)	2.40	.02
Small town or rural						
HC	NA	NA	NA	-0.080 (0.097)	-0.82	.41
LC	NA	NA	NA	0.033 (0.076)	0.43	.66
Elixhauser score (+1)	NA	NA	NA	0.035 (0.004)	9.35	<.001

Abbreviations: ADI, area deprivation index; B, Poisson regression coefficient; HC, high commute; LC, low commute; NA, not applicable.

^b Reference group: White, male, mid-ADI, and metropolitan.

^c Using the false discovery rate approach.

^a Reference group: White.

associations of race/ethnicity for Asian individuals remained significant (IRR, 0.81; 95% CI, 0.75-0.87; $P < .001$, using the FDR approach). Marginal effects analyses showed a mean effect of -15.7% (95% CI, -21.2% to -10.2%; $P < .001$, using the FDR approach) of receiving recommended diagnostic services for Asian beneficiaries. Other variables associated with lower likelihood of diagnostic workup services were older age (IRR for every additional 5 years, 0.98; 95% CI, 0.98-0.99; $P < .001$, using the FDR approach) and greater neighborhood disadvantage (IRR, 0.91; 95% CI, 0.86-0.96; $P = .003$, using the FDR approach) (Figure).

Supplementary and Sensitivity Analyses

We found significant interactions between Black race/ethnicity and greater neighborhood disadvantage with regard to timeliness of diagnosis ($B = 0.713$, $SE = 0.318$; $P = .02$, using the FDR approach), indicating that Black beneficiaries residing in highly disadvantaged neighborhoods had a lower likelihood of receiving a diagnosis of MCI. We also found significant interactions between Hispanic ethnicity and greater neighborhood disadvantage ($B = 0.133$, $SE = 0.050$; $P = .03$, using the FDR approach) in association with the number of recommended diagnostic services, such that the likelihood of receiving a recommended diagnostic workup was lower for Hispanic individuals residing in highly disadvantaged neighborhoods.

Among individuals who received a specialist evaluation, beneficiaries who identified as Asian (OR, 0.40; 95% CI, 0.28-0.55; $P < .001$, using the FDR approach) or Hispanic (OR, 0.60; 95% CI, 0.46-0.78; $P < .001$, using the FDR approach) were less likely than those who identified as White to receive a diagnosis of incident MCI. The comprehensiveness of diagnostic ser-

vices performed (laboratory and neuroimaging studies) did not differ by racial/ethnic group (full models in eTable 6 in the Supplement). Sensitivity analyses using the Medicare Enrollment Database race/ethnicity codes showed equivalent results with small differences in unstandardized coefficients (full models in eTables 7-9 in the Supplement).

Discussion

Early diagnosis of dementia is a public health priority⁴⁻⁹ that will become even more urgent as potential disease-modifying treatments become available.^{10,11} Consistent with our hypotheses, beneficiaries who identified as belonging to a racial/ethnic minority group were less likely than White beneficiaries to receive a timely diagnosis (defined as incident diagnosis of MCI vs dementia) or a comprehensive evaluation. Whereas 23.3% of White beneficiaries received MCI as their first diagnosis, incident MCI diagnosis was less common among Asian (12.3%), Hispanic (15.8%), and Black (18.2%) beneficiaries, even though Black and Hispanic beneficiaries, on average, were younger at incident diagnosis than White beneficiaries. Furthermore, we found that beneficiaries who identified as Asian received a less comprehensive diagnostic evaluation.

After adding demographic and geographical factors to the models, we found that greater neighborhood disadvantage and older age were each independently associated with later diagnosis and a less comprehensive evaluation. Greater comorbidity burden was also independently associated with later diagnosis. Significant interactions indicated that Black beneficiaries residing in disadvantaged neighborhoods were less

likely to receive a timely diagnosis and that Hispanic beneficiaries in disadvantaged neighborhoods were less likely to receive comprehensive evaluations. Asian and Hispanic beneficiaries who had a specialist evaluation did so at a later stage of disease, but no significant racial/ethnic inequalities in the comprehensiveness of the diagnostic evaluation were found among beneficiaries with a specialist visit. These results point to the complex mechanisms underlying health care disparities that must be understood to tailor effective solutions.

We identified significant inequities in diagnostic care among Asian American individuals. The Asian population in California and the US in general is extremely heterogeneous with regard to ethnicity, culture, and language characteristics.^{50,51} About half (49%) of Asian residents of California aged 5 years or older report having limited English proficiency⁵²; for older Asian individuals who do not speak English, language barriers are associated with reduced access to preventive medical care, poor understanding of instructions, and increased risk of misdiagnosis.⁵³ In addition, Asian American individuals may be more likely to rely on complementary and alternative medicine treatment for chronic conditions.⁵⁴ Moreover, the stigma associated with dementia and the cultural values and beliefs that emphasize personal or family responsibility in caring for a person with dementia could delay bringing the patient's condition to medical attention.⁵⁵ Because of delayed and inadequate diagnostic evaluations, Asian American older adults may appear to have a lower prevalence,⁴² and, to some degree, a lower incidence²² of dementia.

Although our primary findings concern racial/ethnic disparities in dementia diagnosis, our results also provide important insights into overall dementia diagnostic practices in California. In particular, less than half of beneficiaries who received a diagnosis of dementia or MCI have received recommended diagnostic services, including a specialist evaluation (34.6%), brain health laboratory testing (16.2%), and structural neuroimaging studies (28.7%). Moreover, our analyses revealed that these services were less likely to be performed for individuals who were older and had a greater comorbidity burden, which underlines the importance of supporting efforts to optimize dementia diagnostic pathways, particularly in general practice settings.

Our study has important implications for health care policy and future research. Specifically, it highlights the need for training and supporting nonspecialist health care professionals who serve patients from racial/ethnic minority groups and disadvantaged communities, strengthening community education and awareness of dementia and its early signs, and outreach by specialists to facilitate referrals from underserved communities at an early stage of disease. Future research should focus on fur-

ther understanding the causes of the observed disparities, including both individual characteristics and contextual factors, to address health care inequality among older adults. Future studies should also examine long-term social and economic outcomes of delayed diagnosis and poorer comprehensiveness of diagnostic services among racially/ethnically diverse older adults to inform policy interventions as dementia prevalence continues to increase. Population-based studies of dementia prevalence and incidence by race/ethnicity must consider the association of delayed diagnosis with findings.

Limitations and Strengths

The limitations of this study are associated with the use of secondary claims data (ie, nonstandard diagnostic approaches and inability to identify preclinical cases), a restricted lookback window to establish incident diagnoses, and limited access to individual-level socioeconomic characteristics (eg, educational level). We relied on the race/ethnicity variables reported in the administrative data that have previously been shown to have limited accuracy in representing individuals who identify as non-White.³⁷ Also, our sample was limited to Medicare fee-for-service beneficiaries in California, and owing to unavailability of data on individuals enrolled in Medicare Advantage plans or who are uninsured, our estimates of racial/ethnic groups likely underrepresent the diversity of the older adult population in California.

Our study also has some strengths, including the fact that we found equivalent results using Research Triangle Institute and Medicare Enrollment Database coding. Another major strength of this study is that this is, to our knowledge, the first empirical analysis of racial/ethnic disparities with regard to the timeliness and comprehensiveness of dementia diagnosis among US older adults. Inclusion of other demographic and geographical factors has also strengthened our findings through identification of additional areas of vulnerability that underlie dementia diagnostic practices.

Conclusions

We found that Asian, Black, and Hispanic Medicare beneficiaries received a less timely diagnosis and that Asian beneficiaries received a less comprehensive diagnostic evaluation compared with White beneficiaries. Our findings highlight substantial gaps in diagnostic care among racially diverse older adults that are likely associated with underrepresentation in clinical trials and inequities in treatment. Major policy and practice efforts are necessary to address these gaps via targeted interventions for vulnerable populations.

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